The account of the Rothamsted experiments on wheat, from the pen of Mr. Lawes, which is appended to the report, will be read with special interest, as showing what important gains to our knowledge may result from such experiments as those initiated at Houghton Farm.

The papers on agricultural physics contained in the second report relate to local meteorology and soil-temperatures. Under the first of these subdivisions the most interesting statement is, that local predictions, based on the signal-service and on local observations, were made at noon for the succeeding twenty-four hours, with only two per cent of error. Confidence in them was established, and they served an important purpose for the time during which they were issued. The observations on soil-temperatures will, of course, yield more trustworthy averages when based on more than a single season's work; but results of value are already obtained. Eight thermometers with the bulbs immersed in oil within wooden cases, to prevent change of record during their observation, were placed at the surface, and at depths of three, six, and nine inches, and one, three, five, and eight feet, and were observed hourly between seven A.M. and nine P.M., from May to October, 1882, and sometimes throughout the twenty-four hours. The soil was gravel upon hardpan and clay. The observations are elaborately discussed by Mr. Penhallow, who obtains the following results. The penetration of the surface-heat to a depth of three inches requires one and a half to two hours; to one foot, eight to ten hours: hence, at a little greater depth than the latter, the diurnal waves of temperature would be reversed. Hourly change of temperature ceases at about eighteen inches, and daily, near eight feet; but these, as well as the average daily variations, being only for the hours from seven A.M. to seven P.M., need supplementary observations to show their full measure. The use of minimum thermometers would greatly increase the value of the results. Irregularities in the daily temperature-curve are considered first as shown in a diminished total variation ('mean depression of hourly variations'), and, second, as seen in marked irregularities in the curve ('sudden depressions'). The first of these is found to be always connected with rainfall and consequent excess of moisture in the soil, probably aided by absence of direct sunshine; the second generally comes either from a temporary obscuration of the sun, as by a passing cloud, or about as frequently from the reaction after a sudden rise of surface-temperature much above that of the soil below.

Of more interest are the comparative results of observations made in June, three inches below the surface, in one uncultivated, and two plots of cultivated ground, referred to in the report as *a* and *b*. One of the cultivated plots, *a*, had been treated with composted stable-manure; the other, *b*, with an equivalent mixture of commercial fertilizer; and both were planted with corn. The uncultivated ground had the greatest daily range, chiefly from its higher maximum temperature; plot *a* had the least range, as its minimum was $\frac{1}{2}°$ to 1° C. higher than in plot *b*. This diminished variation would seem to result from heat evolved by the decomposing manure.

All the observations are neatly recorded in tables and diagrams. Their only inconvenience arises from the use of even numbers of feet or inches in determining the depths for observation, while the records are kept in fractional centimetres; so that 3, 6, and 9 inches are always rendered 7.6, 15.2 and 22.8 cm. One system or the other should be fully adopted. As the first season of observation includes only the warmer months, studies of frost are not yet published.

FOSSIL ALGAE.

Apropos des algues fossiles. Par le marquis de SAPORTA. Paris, *Masson*, 1882. 76 p., 10 pl. l. 4°

IN a fine imperial quarto, the author critically examines the nature of some impressions described by phytopaleontologists as remains of fossil Algae, but which a Swedish naturalist, Nathorst, in a considerable work published at Stockholm (1881), has considered as representing tracks of invertebrate animals. In his memoir, Nathorst illustrates by a large number of figures the tracks and impressions which the author himself and others have observed, as produced by the movements of small crabs, insects, worms, even of water-currents and waves, upon sand, or soft, muddy surfaces. As points of comparison, the Swedish author gives a list of the works where, to his belief, are represented so-called Algae corresponding to his figures. Among the memoirs quoted in the list are Saporta's *Paléontologie française* (vol. i.) — where, among the Jurassic plants, all the Algae, excepting Itieria and perhaps one or two others, are considered as true tracks — and the *Evolution du règne végétal*, by Saporta and Marion, where most of the impressions described as Algae are regarded as tracks of divers kinds. It is to defend his

position, and that, indeed, of phytopaleontology, that Saporta has prepared a really noble volume. He first examines the conditions of the vegetable remains, their mode of preservation, the evidence of their vegetable nature compared with the impressions produced by animals or mechanical agency. On this subject he adds a note of Dr. Marion, who has followed the same line of research as Nathorst, in carefully studying the character of the cells produced by animal agency, and who points out the great difference between these tracks and vegetable impressions. The second part of Saporta's memoir contains a detailed examination of some types of fossil Algae. The species described are represented, as well as their living related types, with admirable care and precision. Some of the documents from which Saporta has derived valuable assistance are from the works or communications of American authors; Harlania Hallii, among others, is beautifully figured. With few exceptions, all the evidence adduced in the admirable work of Saporta is opposed to the opinions of Nathorst, and renders great service to phytopaleontology.

BOLTON'S QUANTITATIVE ANALYSIS.

The student's guide in quantitative analysis, intended as an aid to the study of Fresenius' system. By H. CARRINGTON BOLTON, Ph.D., Trinity college, Hartford, Conn. New York, *John Wiley & Sons*, 1882. 6+124 p. 8°.

THE above title is somewhat misleading; for the book, as stated in the preface, is a series of notes on a system of quantitative analysis, as developed and modified by the author, from a course of instruction originally organized in the School of mines, Columbia college, by Prof. C. F. Chandler. Viewing the book in this light, two things must be taken into consideration, — first, whether the analyses given are typical ones, such as would enable the student, on the completion of the course, to work out by himself the common problems of quantitative analytical chemistry; second, whether the notes given under the various determinations are such as explain, not only the different steps of the process, but also the reasons that necessitate them. The first of these two questions we can answer decidedly in the affirmative. The only criticism that we might make is, that possibly too much attention has been paid to alloys, and not quite enough to complex mineral determinations. The first analysis given is baric chloride, then magnesic sulphate, and other simple salts where no process of separation is necessary. The book then takes up, in well-chosen order, almost all the common alloys and minerals, gives the simpler problems of volumetric work, the determination of carbon, hydrogen, and nitrogen in organic compounds, and many of the most striking commercial tests; such as the examination of sugar, milk, mineral-water, coal, and petroleum. The notes, however, under these different analyses, we cannot consider as perfectly satisfactory. They consist of a short account of the process, with references to Fresenius or the original article, and sometimes a tabulated plan; but no explanation of the various steps is given. If, after each analysis, the reasons why the different reagents had been added, and other numerous details, had been explained, the value of the book would have been much greater; for it is the want of such elucidations in Fresenius that makes his system seem confused and difficult to the young student. As a whole, however, when studied, as intended by the author, in connection with Johnson's translation of Fresenius, or when supplemented by a thorough series of lectures, we can recommend the book as giving a valuable course in quantitative work.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Encke's comet, and a resisting medium in space. — Dr. O. Backlund, in a paper entitled *Kurzer bericht ueber meine untersuchungen ueber die hypothese eines wiederstehenden mittels* (*Mélanges math. et astron.*, vi.), makes the following statement of the results of his researches on Encke's comet: "The investigations hitherto made of the theory of Encke's comet really prove nothing as to the existence of a resisting medium in space. Even if we should succeed by such a hypothesis to explain sufficiently the increase of the mean motion and the decrease of the eccentricity during the period 1819–48, a simple hypothesis like this will not at the same time suffice for the motion of the comet after 1865, as the variation of the mean motion after that time has most probably become different. Not until the period 1865–81, and its connection with the earlier one, have been fully discussed, will it perhaps become possible to find indications of the nature of the unknown forces which act on the comet." — (*Copernicus*, Feb.) D. P. T. [531